

REMARKS

In response to the Office Action mailed May 8, 2003, Applicant respectfully requests reconsideration.

To further the prosecution of this application, amendments have been made in the claims, as shown above under "Listing of the Claims." Claims 1-35 were previously pending in this application. By this amendment, Applicant cancels claim 12 and amends claims 13-16, 19-22, 25-28 and 30-32, such that claims 1-11 and 13-35 are pending for examination, of which claims 1, 13, 16, 25, 32 and 34 are independent.

Applicant notes with appreciation the allowance of claims 1-11.

1. Claim 9 As Amended Overcomes the Objection

In response to the Office Action (Page 2), claim 9 has been amended as shown above by deleting the word "the" occurring after the word "same." Applicant respectfully submits that claim 9 as amended is not confusing, and requests that the objection to claim 9 be withdrawn.

2. Claims 15 and 17 As Amended Satisfy the Requirements of §112, First Paragraph

Claims 15 and 17 stand rejected under §112, first paragraph (Office Action, page 2) as purportedly reciting subject matter that was not adequately described in the specification. Specifically, the Office Action asserts that the term "CMOS" recited in each of claims 15 and 17 is not described or illustrated in the specification. In response, Applicant has amended claims 15 and 17 by replacing the word "CMOS" with the word "MOS". Claims 15 and 17 as amended are clearly supported throughout the specification, including page 3, line 27-page 4, line 5 and in claim 1 as originally filed. Accordingly, Applicant respectfully requests that the rejections of these claims under §112, first paragraph, be withdrawn.

3. Claims 13-31 Patentably Distinguish Over Stevens

Claims 14, 15, 19-21 and 26-31 stand rejected (Page 5) under 35 U.S.C. §102(a) as purportedly being anticipated by U.S. Patent No. 5,306,931 (Stevens). Further, claims 13, 16, 18 and 25 stand object-to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

In response, Applicant has amended claims 13, 16 and 25 as shown above to include all of the limitations of the base claim 12 and any intervening claims. Accordingly, Applicant respectfully submits that claims 13, 16 and 25 are in condition for allowance. Applicant did not amend claim 18 because claim 18 depends from claim 16, which as described above is now in condition for allowance. Accordingly, Applicant respectfully submits that claim 18 is now in condition for allowance.

Further, Applicant has amended claims 14, 19-22, 26-28, 30 and 31 as shown above to depend from claim 13, which, as described above, is now in condition for allowance. Accordingly, Applicant respectfully submits that these claims are in condition for allowance, and requests that the rejection of these claims under §102(b) be withdrawn.

Claims 15, 17, 23, 24 and 29 each depend from one of claims 13, 16, 22 or 28, which, as described above, are now in condition for allowance. Accordingly, Applicant respectfully submits that these claims are in condition for allowance, and requests that the rejection of the claims under §102(b) be withdrawn.

4. Claims 32 and 33 Patentably Distinguish Over Lee

Claims 32 and 33 stand rejected (Page 5) under 35 U.S.C. §102(e) as purportedly being anticipated by U.S. Patent No. 6,051,447 (Lee). Applicants respectfully traverse this rejection..

4.1 Discussion of Lee

Lee is directed to active and passive pixels sensors including photo-sensing elements within pixels that provide improved dark current, blue quantum efficiency, image lag and fill factor characteristics. (Col. 1, lines 16-21). Lee discloses an active pixel sensor that includes a partially-pinned photodiode 30 incorporating anti-blooming control without reducing the charge capacity of the sensor. (Col. 7, lines 17-20; Fig. 7A).

In the current application, Applicant incorporates the Lee patent by reference (Page 5, lines 3-6). Applicant represents Fig. 7A of Lee with Fig. 5 and describes Lee with reference to Fig. 5 as follows. Fig. 5 illustrates a structure of monolithic implementation of the series association of such a photodiode and of a precharge transistor. (Page 5, lines 7-9).

Precharge transistor M1 and completely depleted photodiode D are formed in a lightly-doped semiconductor substrate 21 of a first conductivity type, for example, type P (P-). More specifically, transistor M1 and photodiode D are formed in an active region delimited by field

insulation areas 22, for example, silicon oxide. This active area corresponds either to a portion of substrate 21, or to a P-type well 23 formed from the surface of substrate 21, but more heavily doped and relatively deep. At the surface of well 23, to the right of Fig. 5, source and drain regions 26 and 27 of precharge transistor M1 have been formed on either side of an insulated gate structure 24 possibly provided with lateral spacers 25. Source 26 and drain 27 are heavily-doped regions of a conductivity type opposite to that of substrate 21, for example, N (N+). Gate 24, source region 26, and drain region 27 are solid with metallizations (not shown), which are respectively connected to a precharge control circuit which provides precharge signal Rs, to the gate of transistor M2, that is, node I, and to high power supply Vdd. (Page 5, lines 10-22)

In the left-hand portion of Fig. 5 is formed an N-type doped region 28, which extends to substrate 21 and is in contact with source region 26. Region 28 is less heavily doped than source 26. Region 28, outside of its contact with source 26, is covered with a P-type region 30, heavily doped, also in contact with substrate 21 via well 23. Substrate 21 is permanently connected to a low reference supply or circuit ground. Accordingly, during the entire operation of the device, well 23 and region 30 are also maintained at the reference voltage of the circuit. (Page 5, lines 23-30)

During the precharge, transistor M1 is on and the charges photogenerated in cathode region 28 of the photodiode evacuate via source region 26 to drain region 27. Since anode 30 of the diode is heavily doped and region 28 is relatively thin, the space charge area tends to extend across the entire thickness of region 28, which is completely depleted. The junction capacitance seen from node I is null. Photodiode D behaves as a capacitor having a substantially null capacitance and, during the precharge, region 28 self-biases to a voltage value Vs set only by the relative dopings of region 28 and of surface region 30. This voltage is thus theoretically no longer affected by supply noise. (Page 6, lines 2-9)

Fig. 6 illustrates the voltages in the different regions of Fig. 5. In region 28, the voltage of the photodiode is at most Vs, which is a fixed precharge value, smaller than the value of high power supply Vdd. (Page 6, lines 10-13).

As noted in Applicant's specification (page 5, line 14-24), a disadvantage of Lee's structure is the potential difference between source region 26 and cathode region 28 of the photodiode. Indeed, after the precharge step, during a lighting, the storage of the photogenerated charges starts in the region having the highest voltage, that is, in source region 26, before taking

place in cathode region 28. In the subsequent reading, as illustrated in Fig. 7E of the above-mentioned Kodak patent, everything occurs, as seen from node I, as if two successive capacitances would discharge. Thus, **there is a non-linearity of the gate control signal of control transistor M2. This non-linearity of the control signal translates as a non-linearity of the output signal provided to input terminal P of the processing circuit** (emphasis added).

In contrast to the assertions of the Office Action (Page 6), Figs. 7E and 8E of Lee do not disclose outputting linear signals to a processing circuit, but disclose outputting *non-linear* signals, each non-linear signal including two linear *regions* that form the non-linear signal.

4.2 Claim 32 is Not Anticipated By Lee

Claim 32 has been amended to further clarify Applicant's contribution to the art. Claim 32 is not anticipated by Lee because Lee fails to disclose the method recited in claim 32 as amended. Specifically, Lee does not disclose a method of operating a photodetector including a photodiode of a fully-depleted-channel type and a precharge transistor having a source region that serves as a cathode of the photodiode, the method comprising: accumulating photogenerated charges within the photodiode; and **outputting from the photodiode a first linear signal representing the accumulated photogenerated charges**, as recited in claim 32. In contrast, as discussed above, Lee disclose outputting from a photodiode a *non-linear* signal representing the charges accumulated within the photodiode.

Therefore, for at least these reasons, claim 32 is not anticipated by Lee. Accordingly, Applicant respectfully requests that the rejection of claim 32 under §102(e) as being anticipated by Lee be withdrawn.

Claim 33, which depends from claim 32, patentably distinguishes over Lee for at least the same reasons as claim 32. Accordingly, Applicant respectfully requests that the rejection of claim 32 under §102(e) be withdrawn.

5. Claims 34 and 35 Patentably Distinguish Over Lee

Claims 34 and 35 stand rejected (Office Action, Page 5) under 35 U.S.C. §102(a) as purportedly being anticipated by Lee. Applicants respectfully traverse this rejection because Lee does not disclose an apparatus, comprising: a photodiode of fully-depleted-channel type operable to accumulate photogenerated charges; a precharge transistor having a source region serving as a cathode of the photodiode; and means for outputting from the photodiode a **linear** control signal

representing the photogenerated charges, as recited in claim 34. Accordingly, Applicant respectfully requests that the rejection of claim 34, and claim 35, which depends from claim 34, under §102(e) as being anticipated by Lee be withdrawn.

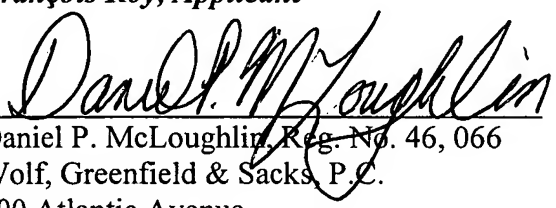
CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

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Docket No.: S1022.80748US00
Date: October 8, 2003
x10/08/03